

G05DDF – NAG Fortran Library Routine Document

Note. Before using this routine, please read the Users' Note for your implementation to check the interpretation of bold italicised terms and other implementation-dependent details.

1 Purpose

G05DDF returns a pseudo-random real number taken from a Normal (Gaussian) distribution with mean a and standard deviation b .

2 Specification

```
real FUNCTION G05DDF(A, B)
real                A, B
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{1}{b\sqrt{2\pi}} \exp\left(-\frac{(x-a)^2}{2b^2}\right)$$

The routine uses the method of Brent [3].

G05FDF may be used to generate a vector of n pseudo-random numbers from a Normal distribution, but these are **not** the same as n successive values of G05DDF, because G05FDF uses a different method. However on vector-processing machines G05FDF is likely to be much faster.

4 References

- [1] Knuth D E (1981) *The Art of Computer Programming (Volume 2)* Addison–Wesley (2nd Edition)
- [2] Kendall M G and Stuart A (1969) *The Advanced Theory of Statistics (Volume 1)* Griffin (3rd Edition)
- [3] Brent R P (1974) Algorithm 488 *Comm. ACM* 704

5 Parameters

- 1: A — *real* *Input*
On entry: the mean a , of the distribution.
- 2: B — *real* *Input*
On entry: the standard deviation b , of the distribution. If B is negative, the distribution of the generated numbers – though not the actual sequence – is the same as if the absolute value of B were used.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

The example program prints the first five pseudo-random real numbers from a normal distribution with mean 1.0 and standard deviation 1.5, generated by G05DDF after initialisation by G05CBF.

9.1 Program Text

Note. The listing of the example program presented below uses bold italicised terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*      G05DDF Example Program Text
*      Mark 14 Revised.  NAG Copyright 1989.
*      .. Parameters ..
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
*      .. Local Scalars ..
      real              X
      INTEGER          I
*      .. External Functions ..
      real              G05DDF
      EXTERNAL          G05DDF
*      .. External Subroutines ..
      EXTERNAL          G05CBF
*      .. Executable Statements ..
      WRITE (NOUT,*) 'G05DDF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      DO 20 I = 1, 5
*
*          X = G05DDF(1.0e0,1.5e0)
*
*          WRITE (NOUT,99999) X
      20 CONTINUE
      STOP
*
      99999 FORMAT (1X,F10.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

G05DDF Example Program Results

```
1.8045
2.9393
3.3701
0.9602
3.2751
```